

Remarks

I. Status of the Application

Originally-filed claims 1-23 have undergone a first examination, after which:

Claims 1-3 and 8 stand rejected under 35 USC § 103(a) as being unpatentable over Dujmenovic (US 6,980,767) in view of Wolkstein (US 5,222,246);

Claims 4-6 stand rejected under 35 USC § 103(a) as being unpatentable over Dujmenovic and Wolkstein in view of Satoh (US 6,983,129);

Claim 10 stands rejected under 35 USC § 103(a) as being unpatentable under 35 USC § 103(a) over Dujmenovic, Wolkstein and Satoh in view of Sanada (US 6,862,442);

Claims 7, 11-13 and 21-22 stand rejected under 35 USC § 103(a) as being unpatentable over Dujmenovic in view of Wolkstein (US 5,222,246) and Aggarwal (US 6,985,698);

Claims 14-18 and 20 stand rejected under 35 USC § 103(a) as being unpatentable over Dujmenovic, Wolkstein and Aggarwal in view of Satoh; and

Claim 23 stands rejected under 35 USC § 103(a) as being unpatentable over Aggarwal in view of Wolkstein.

Claim 1 is now amended to include the features of claim 2. In particular, claim 2 recites the feature that the termination port of the phase shift circuit is either the in-phase mixer port (I-port), or the quadrature phase mixer port (Q-port). A particular embodiment of this arrangement can be seen in Fig. 3B in which the Q-port of phase shifter 334 operable for receiving the Q-phase signal 337a operates as the termination

port 338. Claim 11 is similarly amended to include the aforementioned features recited in claim 12. Claim 23 is similarly amended in means-plus-function language.

Claims 2 and 12 are herewith cancelled without prejudice.

Applicant requests reconsideration of the pending claims 1, 3-11, and 13-23 in view of the foregoing amendments and following remarks.

Claim 1 includes the features of claim 2 to which Dujmenovic '787 and Wolkstein '246 have been applied in the Examiner's Office Action. Independent claim 11 includes the features of claim 12, to which Dujmenovic '787, Wolkstein '246, and Aggarwal '698 have been applied. Claim 23 recites means-plus-function features equivalent to those in claims 1 and 11, references Wolkstein '246, and Aggarwal '698 being applied to claim 23 previously. Applicant submits that independent claims 1, 11 and 23 are novel and inventive over the applied reference group of Dujmenovic '787, Wolkstein '246, and Aggarwal '698, as well as the remaining references of references Satoh '129 and Sanada '442.

The Present Invention

The present invention provides an impedance-matched IQ network having a phase shifting circuit coupled to a back termination. The phase shift circuit is configured to provide substantially a ± 90 degree phase shift between in-phase and quadrature-phase mixer ports of the phase shifting circuit. The back termination is coupled to a termination port of the phase shift circuit, the back termination being impedance-matched to the termination port to reduce the amplitude of signal reflections in the IQ network, and provide improved performance, e.g., lower IQ phase error. As now further specified in claims 1, 11 and 23, the termination port forms either the in-phase mixer port or the quadrature phase mixer port, a particular example of the circuit shown in Fig. 3B. As shown in Fig. 3B, the termination port may comprise one side of a differential I- or Q-port (termination port 338 coupled to side 337a of the Q-port 337a,b).

Dujmenovic '787 Distinguished

The differences between the present invention and Dujmenovic '787 can be better understood by referring to the prior art image rejection circuits shown in Fig. 1 of Dujmenovic '787 and Fig. 1 of the present invention, and subsequently distinguishing those circuits from the image rejection circuit of Fig. 2 in Dujmenovic '787. As can be seen in the comparison of Figs. 1 of Dujmenovic '787 and the present invention, each describe the conventional Hartley image rejection circuit architecture, Fig. 1 showing the signal path in a single-ended topology, and Dujmenovic '787 showing the signal path in a differential signal topology.

Next with reference to Fig. 2 of Dujmenovic '787, the invention there can be seen as the implementation of a ring oscillator 24 which is used to generate the I-and Q-signals supplying mixers 28 and 30. The IQ network itself, formed by the phase shift circuit 38 and combiner 40, is not altered. Dujmenovic '787 simply builds upon the use of the conventional Hartley IQ network to construct a new image rejection circuit without presentation of any new features to the IQ network. The present invention is distinguished from Dujmenovic '787 in that Dujmenovic '787 teaches an improvement (ring oscillator 32) in the generation of the I- and Q-signals which feed a conventional IQ network, whereas the present invention is directed to a new IQ network itself.

Several distinctions appear between the two structures as a result of the aforementioned differences. For example, Dujmenovic '787 does not teach or suggest a phase shift circuit having *both* I-and Q-ports to receive respective I-and Q-signals. Dujmenovic's phase shift circuit 38 includes *either* an I- or Q-port (shown as a Q-port to receive a Q-signal from mixer 28), but not both I-and Q-ports for receiving respective I-and Q-signals. Regarding the asserted grounds for rejection that Dujmenovic '787 discloses "a phase shift circuit 38 having an in-phase mixer 30 configured to receive an in-phase signal from amplifier 58, a quadrature phase mixer port 28 configured to receive the quadrature phase signal from amplifier 58," the Applicant respectfully disagrees. The Applicant observes that the phase shift circuit 38 is configured to

receive *only one* of the I- or Q-signals (shown as the Q-signal), that being the signal output from mixer 28. The phase shift circuit 38 does not include a port configured to receive the second signal (shown as the I-signal).

As the Examiner notes, the present invention is further distinguished from Dujmenovic '787, in that Dujmenovic '787 does not teach a back termination coupled to a phase shift circuit termination port. The Applicant notes additionally that Dujmenovic '787 does not disclose a phase shift circuit whereby either the I- or Q-port operates as a termination port, as now recited in claims 1, 11 and 23.

Aggarwal '698 Distinguished

Aggarwal '698 is directed primarily to an impedance matching circuit and method for wideband high frequency devices, and is similarly deficient as to any teaching or suggestion of a phase shift circuit operable to receive both I- and Q-signals. Reference is made to Fig. 1 in which phase shifters 6 and 12 are shown in their conventional configuration, each phase shifter 6 and 12 including a single input port for receiving a single signal. IF Phase shifter 8 is similar configured to receive a single input signal and to apply a phase shift thereto.

As Aggarwal '698 does not show or suggest I- and Q-ports for receiving respective I and Q phase signals, Aggarwal '698 is necessarily deficient in showing or suggesting: (i) a termination port or back termination coupled to the missing I-or Q-ports, or (ii) either of the missing I or Q-ports functioning as a termination port.

Wolkstein '246 Distinguished

As noted by the Examiner, Dujmenovic '787 does not teach a back termination coupled to a termination port of the phase shift circuit as recited in claims 1, 11 or 23. Wolkstein '246 is cited as making up for this deficiency, Wolkstein teaching a termination 226 coupled to a termination port 224 of a hybrid coupler.

Applicant observes that Wolkstein'246 does not make up for the aforementioned deficiencies of Dujmenovic '787 or Aggarwal '698, as Wolkstein '246 does not teach or suggest a phase shift circuit having I- and Q-ports for receiving respective I and Q signals, one of the I- and Q-ports operating as a termination port, the termination port coupled to a back termination. The remaining references Satoh '129 and Sanada '442 do not make up these deficiencies.

Accordingly, as the Dujmenovic '787, Aggarwal '698, Wolkstein'246, Satoh '129, or Sanada '442, either individually or collectively, neither show nor suggest a phase shift circuit having I- and Q-ports for receiving respective I-and Q-signals, one of the I-and Q-ports operating as a termination port, the termination port coupled to a back termination, claims 1, 11 and 23 reciting said features is allowable thereover. Claims 3-10 are allowable for at least the reasons by virtue of their dependency upon claim 1. Claims 13-22 are similarly allowable for at least the same reasons by virtue of their dependency upon claim 11.

Conclusion

The Applicant submits that the pending claims 1, 3-11, and 13-23 are allowable over the prior art, and accordingly requests the issuance of a Notice of Allowance. Should the Examiner believe an interview would expedite prosecution of the case, a telephone call or e-mail to the Applicants' representative is invited.

Respectfully submitted,



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